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New mosses of North America. I.

F. RENAULD AND J. CARDOT.

(WITH PLATES XIII-XX.)

Dicranella Fitzgeraldi.—Cespitose, yellowish or dirty green. Stems 5–15 mm. long, simple or bipartite. Leaves crowded, subsecund, from a lanceolate base gradually narrowed into a long subulate canaliculate point, denticulate at the apex; 3–3½ mm. long, ⅓ mm. broad; costa broad, ⅓ width of leaf-base, occupying nearly all the point; cells of the areolation rectangular or subrectangular, firm, more or less elongated. Perichætial leaves from a dilated sinuate-denticulate base abruptly subulate, denticulate at the apex. Pedicel yellowish, 7–15 mm. long, twisted to the left, but rather to the right above. Capsule erect, symmetric, oblong, not constricted under the orifice, very slightly plicate when dry, brown or yellowish; length 1½ mm., diameter ½ mm.; lid convex, obliquely long rostrate; teeth purple or orange-colored, densely trabeculate, striolate lengthwise, faintly granulose, cleft to below the middle into two very long-subulate legs, quite free or partly connected. Male flowers unknown.

Florida: on sandy ground near Palatka (*Fitzgerald*).

This species is readily distinguished from D. heteromalla by the symmetric erect capsule, and the teeth of the peristome cleft to below the middle into two narrower and more elongated legs. It is more closely allied to *D. stenocarpa* Besch., a tropical species from Martinique and Guadaloupe islands, from which it differs in its more acute leaves, denticulate at apex, the capsule not constricted under the orifice, and the peristome less papillose.

Sterile specimens gathered in Louisiana by Mr. A. B. Langlois, which we had at first referred to D. heteromalla, may belong to D. Fitzgeraldi.

Campylopus Henrici.—Cespitose, yellowish green. Stems very short, without tomentum. Leaves slightly secund, lanceolate-subulate and semitubulose from an oblong base,

the upper generally tipped with a short hyaline denticulate and often broken point; 3–4 mm. long, ½ mm. broad; basilar cells rectangular, 3–4 times longer than broad, those of the angles sometimes rather soft and yellowish, but not forming distinct auricles, the upper elongated, straight, linear; costa broad, about ⅓ the width of leaf-base, of 4–5 strata of cells, 2–3 inferior of small thick-walled cells, one median of large thin-walled cells, and one superior of small thin-walled cells, this often incomplete, and then occupying only the middle of the costa. Male flowers small, gemmiform, placed near the top of the stems; bracts ovate, concave, rather suddenly acuminate, thin-nerved; antheridia rather numerous, with some paraphyses. Female flowers and capsule unknown.

Kansas: Saline County, on sandy ground, where it was discovered by the late *Joseph Henry*.

Resembles a stunted form of *C. brevipilus* B. S., and has also rather the appearance of *C. brevifolius* Sch. Differs from the first by the straight rectangular thin-walled cells of the areolation; from the last by the nerve less broad, the leaves often hyaline at the apex and the cells elongated; and from both by the structure of the costa.

Rhacomitrium Oreganum.—Robust, in wide yellowish tufts. Stems prostrate and a little naked below; branches erect, 4–5 cm. long, simple or dichotomous, and with very few short branchlets. Leaves appressed when dry, erect-spreading when moist, generally more or less homomallous at the top of the branches, ovate, or broadly ovate-lanceolate, acuminate, carinate, slightly plicate below, sometimes obtuse, generally acute, muticous or with a short hyaline apiculus or a more or less elongated, shortly decurrent, slightly serrulate hair-point; borders revolute from the base to near the apex; costa percurrent, prominent on the back; cells thick-walled, linear, very sinuous, the lower most elongated, the upper 2–4 times longer than broad, slightly papillose. External perichætial leaves shortly piliferous, the inner muticous, of a more delicate texture of thin-walled and scarcely sinuous cells. Pedicel reddish, paler above, twisted to the left, 12–18 mm. long. Capsule oblong-cylindrical, brownish, 3–3½ mm. long, 1 mm. broad; lid long-beaked; annulus large; teeth purple, very long, cleft to the base into two filiform, often unequal, nodulose and faintly papillose legs; calyptra conical, long-acuminate, brownish at apex, laciniate-lobulate at base.

Oregon: on rocky hill-sides. (*Th. Howell.*)

A remarkable species, intermediate between R. canescens and R. heterostichum, but more closely allied to the last, from which it differs by the aspect, the yellowish color, the robustness and thickness of the stems, the pedicel twice longer and the teeth much more elongated. It is at first sight distinguished from all the forms of R. canescens by the percurrent costa, the hair not papillose, and the capsule cylindrical, not inflated below. Its simple or scarcely ramulose branches give to this species rather the facies of a Dryptodon.

Webera camptotrachela.—Stems erect, slender, simple or with few branches, 5–10 mm. long. Leaves little crowded, erect, narrowly oblong-lanceolate, acuminate, acute, 1¼–1½ mm. long, ⅓ mm. broad; borders plane or slightly revolute below, distantly denticulate in the upper part; costa strong, percurrent; cells of the areolation elongated, subhexagonal or rhomboidal, 6–10 times longer than broad. External perichætial leaves more elongated, long narrowed-acuminate, more or less revolute on the borders, serrulate, with the costa generally excurrent; 2 or 3 inner bracts, smaller and shorter. Pedicel reddish, flexuous, often geniculate at base, 20–25 mm. long. Capsule small, sub-horizontal or cernuous, oblong-subpyriform, tawny-brown, with a long attenuated curved collum; lid convex, apiculate; annulus formed of two rows of cells; teeth yellowish, densely trabeculate; segments of the inner peristome generally imperfect; cilia variable in length. Male plant distinct.

California.

Very closely allied to W. annotina (of which it may be only a sub-species), but differing in its curved collum and the imperfection of the inner peristome, which is often reduced to a single membrane irregularly laciniate.

Polytrichum Ohioense Ren. & Card. Revue Bryologique, 1885, p. 11.—Stem erect, simple or bipartite, 3–6 cm. long, a little tomentose below. Leaves spreading when moist, erect-flexuous when dry, from a sheathing base, linear-acuminate, cuspidate, serrate; lamellæ about 50, each in section of a row of 5–7 cells, the marginal one much larger, transversely dilated, about twice broader than high, very slightly convex, often almost plane. Perichætial leaves longer, with a longer hyaline base. Pedicel 4–8 cm. long, reddish below, pale above. Capsule erect, finally horizontal, tetragonal or pentagonal, rarely hexagonal, acute-angled, rather narrowed

toward the base, with a very small or indistinct hypophysis; length 5–7 mm., diam. 2–2½ mm.; lid conic-acuminate, red at margin.

We originally described this very good species in 1885, in the *Revue Bryologique*, upon specimens gathered in Ohio by Mr. Provost. Since then, Mr. H. A. Green communicated to us this moss as P. formosum from N. Carolina, Crowdin Mount, and Mr. Ch. R. Barnes from several localities of New Hampshire (*Bailey*) and Wisconsin (*Lapham*). We have also recognized it in a specimen issued as P. formosum in Sulliv. et Lesq. *Musci Bor. Americani* no. 323, without locality. Besides, Mr. Barnes wrote us lately: "I have had all our Polytrichums carefully studied. We found your P. Ohioense far commoner than P. formosum; indeed, we have no specimen of P. formosum in our collections from N. America. We have P. Ohioense from Lafayette, Indiana; summit of Mt. Mansfield, Vermont; Dells of the Wisconsin, Milwaukee and Manitowoc, Wisconsin." Therefore, it is probable that our species is broadly scattered in the United States, where hitherto it has been confounded with P. formosum, from which it is readily distinguished by the form of the capsule, more or less narrowed toward the base, and with an indistinct hypophysis, and chiefly by the form of the marginal cells of the lamellæ, a character which separates it from all the other species of Polytrichum. The true P. formosum seems to be very rare in North America. We have it only from Miquelon Island, near Newfoundland, where it was gathered by Dr. Delamare. In this species, as in P. gracile, the capsule is rounded at base, with a distinct hypophysis, and the marginal cells of the lamellæ are in section ovate, higher than broad, and of same size as the others or only a little larger. The P. commune is still more different by its very distinct annular hypophysis and the marginal cells of the lamellæ hollowed and semilunar in section.

Fontinalis Howellii.—Rigid, yellowish green. Stem 10–15 cm. long, subligneous, flexuous, naked below, pinnate and partly bipinnate. Branches spreading, for the most part arched downward, of a plumose aspect. Stem-leaves becoming gradually larger toward the top of the innovations, erect-appressed, broadly ovate, shortly acuminate, concave, subcarinate or only plicate, cucullate or lacerate at the apex; upper leaves 5–7 mm. long, 2–3 mm. broad; the lower much smaller. Branch-leaves very different, narrowly lanceolate,

concave, not carinate, long acuminate-tubulose, rigid, erect-spreading, 3–4 mm. long, 1–1¼ mm. broad, in three very distinct ranks. Cells of the areolation long linear, rather firm, those of the angles more or less enlarged and generally brownish or ferruginous. Perichætial leaves rounded-obtuse and lacerate at the apex. Capsule entirely concealed in the perichætium, 2 mm. long, ½–¾ mm. broad; lid unknown; teeth about 1 mm. long, narrow, linear-acuminate, slightly papillose, often connected in pairs at the apex, with 20–25 lamellæ on the inside, not perforated on the dorsal line; lattice-cone of the inner peristome strongly papillose, the lower transverse bars appendiculate.

Oregon: on old logs in swamps (*Th. Howell*).

Already in 1881 Mr. Lesquereux communicated to us this plant; but the specimen was poor and sterile. Recently we have received from Mr. Th. Howell good fertile specimens of this very fine moss, which is at first sight distinguished from all congeners by its strikingly rigid aspect, the arcuate branches and the dimorphous leaves, the branch-leaves being narrow and tubulose in the upper part.

Fontinalis flaccida.—Plant very soft, yellowish. Stems slender, naked below, 25–35 cm. long; branches subpinnately ramulose; branchlets spreading, slender, distant. Leaves soft, distant, open, but convolute-imbricate at the top of the ramuli, elongated, narrowly lanceolate, plane or nearly so, obtuse or truncate, and slightly denticulate at the apex; 5–7 mm. long, 1–1½ mm. broad. Cells thin-walled, the median very long, 10–20 times longer than broad, the upper much shorter; those of the angles large, lax, subrectangular or subhexagonal, hyaline or brownish, forming very distinct auricles. Flowers and capsule unknown.

East Louisiana: in the branches and roots overflowed in the Bayou Bonfouca (*A. B. Langlois*).

A remarkable species, readily distinguished, although sterile, by its very soft lax-foliate stems and its long, plane or scarcely concave leaves. The æstival form of *F. biformis* Sulliv., which resembles it by the structure of the leaves, is quite distinct by its rather rigid facies and its leaves shorter, more crowded, less distinctly auricled, erect and convolute-imbricate throughout the length of the branchlets. The *F. filiformis* Sull. & Lesq. and *F. disticha* Hook., which have also some affinities with our species, differ much from it by their facies and their leaves concave, canaliculate or tubulose the upper part.

Camptothecium Amesiæ.—Widely cespitose, bright yellowish-green. Stems prostrate, creeping, radiculose, pinnately ramulose, 8–12 cm. long; branchlets crowded, short, equal, erect, a little curved, 5–10 mm. long. Stem-leaves broadly triangular, narrowly long-acuminate. Branch-leaves ovate-lanceolate, shortly acuminate, carinate, plicate, generally plane on one side and revolute on the other, slightly serrulate at the apex, 1¼ mm. long, ½ mm. broad; costa vanishing in the acumen; cells of the areolation linear, attenuated, 10–15 times longer than broad, the upper shorter, the alar numerous, quadrate or subrectangular. Inner perichætial leaves ecostate, narrowly lanceolate and long-acuminate, entire. Pedicel short, 8–12 mm. long, purple, rough, a little twisted to the left. Capsule narrow, long-cylindrical, suberect or subhorizontal and slightly arcuate; lid unknown; teeth orange, long acuminate-subulate, strong, densely trabeculate; segments split their whole length; cilia long.

California: Auburn, mixed with *Hypnum pinnatifidum* Sull. & Lesq. (*Mrs. Mary E. Pulsifer Ames*).

This species is intermediate between *Hypnum Nuttallii* Wils. and *H. pinnatifidum* Sull. & Lesq., differing from the first by its branch-leaves not dentate at the base, the teeth of the peristome narrower and more narrowly acuminate-subulate and the cilia longer; from the last by its narrow, long-cylindrical capsule; and from both by its branch-leaves broader and shortly acuminate. By this last character it is related to *H. Nevadense* Lesq., but this species is distinguished by the facies, the mode of growth, the erect symmetric capsule, the inner perichætial leaves coarsely sinuate-dentate in the upper part and abruptly narrowed into a very long filiform point, and, finally, by the less perfect peristome, characters which compel us to separate this plant from the genus Camptothecium and to place it in Homalothecium (*H. Nevadense* Ren. & Card.).

Stenay, France.

EXPLANATION OF PLATES XIII–XX.—All figures enlarged 80 diameters or more are copied by means of Nachet's camera lucida:

PLATE XIII. *Dicranella Fitzgeraldi.*—*a*, entire plant; *b b*, stem leaves; *c c*, point of same; *d*, areolation of the base of same; *e*, perichætial leaf; *f f*, capsule; *g*, lid of same; *h*, portion of the peristome.

PLATE XIV. *Campylopus Henrici.*—*a a*, leaves; *b*, point of same; *c*, areolation of the base; *d d*, transverse section; *e*, male flowers; *f*, bract of same.

PLATE XV. *Rhacomitrium Oreganum.*—*a*, entire plant; *b b b*, leaves; *c c c*, point of same; *d*, areolation of the upper part; *e*, capsule, pedicel and perichætium; *f*, capsule with the lid; *g*, portion of the peristome.

PLATE XVI. *Webera camptotrachela.*—*a*, entire plant; *b b*, leaves; *c*, areolation of the middle; *d d*, external perichætial leaves; *e*, inner perichætial leaf; *f*, capsule with the lid; *g g*, capsule deoperculate; *h*, portion of the external peristome; *i*, portion of the inner peristome.

PLATE XVII. *Polytrichum Ohioense*, compared with P. formosum, P. gracile and P. commune.—*a*, transverse section of the lamellæ of the leaves of P. Ohioense; *b*, ditto of P. formosum; *c*, ditto of P. gracile; *d*, ditto of P. commune; *e e*, capsule of P. Ohioense; *f*, capsule of P. formosum.

PLATE XVIII. *Fontinalis Howellii.*—*a*, entire plant; *b b*, upper stem-leaves; *c c*, branch-leaves; *d*, perichætial leaf; *e*, capsule; *f*, portion of the external peristome; *g*, portion of the lattice cone.

PLATE XIX. *Fontinalis flaccida.*—*a a*, leaves; *b b*, point of same; *c*, areolation of an auricle; *d*, areolation of the middle.

PLATE XX. *Camptothecium Amesiæ.*—*a*, entire plant; *b*, branch leaf; *c*, areolation of the base of same; *d*, perichætial leaves; *e e*, capsule with pedicel; *f*, portion of the outer and inner peristome.

Zygomorphy and its causes. II.

CHARLES ROBERTSON.

As soon as a shallow flower becomes horizontal the insect relations change, and certain modifications which would be corrected in vertical flowers become advantageous. While the flower is erect, the horizontal petals form a convenient landing. When the flower turns to one side, the petals become vertical, and the stamens and styles, which become horizontal, form the landing. The flower immediately becomes sternotribe, and this shows how an apparently trivial variation may be of great functional importance. The pollen, instead of being scattered indefinitely on all sides of the insect, is now limited to the under side. It will be advantageous for the stamens and styles to bend so as to strike the ventral surface of the bee with more precision.

The upper nectary, being in front of the landing, is most convenient, and is first to be sucked. To suck the lower nectaries, the bee must turn and hang under the stamens, a very inconvenient operation which causes delay. This view and, in fact, the whole theory stated in this paper was suggested by the action of a bee, *Synhalonia speciosa* Cress.,[12] on the flowers of Geranium maculatum.

The flowers are terminal and vertical, or nearly so, and insects light upon the petals. Humble-bees, which seem best adapted to fertilize the flower, pull it down by their weight so as to invert it, as observed by Prof. Macloskie.[13]

[12] The bees mentioned in this paper were named by Mr. E. T. Cresson.
[13] BOT. GAZ. IX, 157.

Smaller visitors do not bend the peduncles. The Synhalonia bent them so that the stamens and styles turned to an horizontal position. To keep her body upright, the bee took a position on the upper side of these, and sucked only the upper nectary. When she visited a few flowers which were bent to one side, she lighted on the stamens and sucked the upper nectary. Only once did she insert her proboscis into all of the nectaries, and then with difficulty, since she had to turn upside down and hang to the stamens.

The very fact that a bee lighting on the stamens sucks the upper nectary first must have a serious influence on the lower ones. Since bees are often disturbed before they have emptied all of the nectaries, the one which is most convenient is most likely to be sucked. Darwin has observed[14] that "when flowers having more than a single nectary are visited by many bees, so that the nectar is exhausted in most of them, the bees which afterward visit such flowers insert their proboscides only into one of the nectaries, and if they find this exhausted they instantly pass to another flower." Now, suppose a bee neglects the lower nectaries from being disturbed, or, like the Synhalonia, because it objects to reversing, the next bee trying the upper nectary and finding it empty will come to the erroneous conclusion that the lower also are empty, and may neglect them on that account.

The first change toward zygomorphy is for the stamens and styles to turn down at the bases and up at the tips, so as to strike the ventral surface of the bee more effectually, and this is an additional cause of the abortion of the lower nectaries, by rendering them less accessible.

Hibiscus lasiocarpus[15] is a good example of a flower in the first stage of irregularity. When the flower is open, insects light on the base of the staminal column. The free ends of the filaments are directed from the upper and lateral portions of the column, so as to dust the ventral surface of the bee which lights upon them. The styles are bent upward, holding the five capitate stigmas in such a position that bees strike them before they land. After sucking, the bees crawl out over the filaments and upon the lower petals, leaving the flower without again touching the stigmas.

Most of the flowers are as in fig. 1, one nectary (3) is

[14] Orchids, 42.

[15] The flower is adapted to larger bees, Apidæ, of which I have found the following: *Bombus separatus* Cress. (f), *B. Pennsylvanicus* De Geer. (n), *Apathus clatus* Fabr. (m), *Melissodes bimaculata* St. Farg. (m), *Emphor bombiformis* Cress. (mf), *Megachile brevis* Say (m).

uppermost, and the column is bent down, so as to come between 1 and 5.

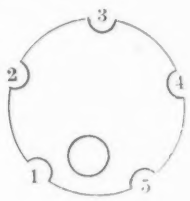

Fig. 1.

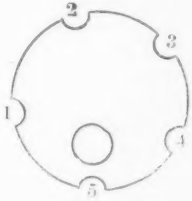

Fig. 2.

Emphor bombiformis is by far the most abundant visitor. Indeed, in two seasons' collecting of insects on flowers, I have failed to find this bee except on this plant. The female visits the flower for honey and pollen, her loose scopa being well adapted to hold the large grains. The male comes for honey and in search of the female. In sucking, this bee generally begins with 4 and turns to the left, often missing 5, but sometimes reversing, so as to empty all. Of 27 individuals, only 10 sucked 5 nectaries, 17 missing one or more. The 27 sucked 113 out of a possible 135 and missed 22.

Bombus Pennsylvanicus, which is next in abundance to the Emphor, generally begins with 2 and sucks to the right, rarely reversing, so that it usually misses 1. It often misses 5, also, especially when this nectary is under the column, as in fig. 2. Of 56 individuals, only six sucked 5 nectaries, 50 missing one or more. The 56 sucked 195 out of a possible 280 and missed 85.

Compared with Emphor bombiformis, Bombus Pennsylvanicus misses the lesser nectaries more frequently. The Emphor, therefore, has more influence in preserving the regularity of the flower. Now, if this bee becomes less frequent on account of competition with the more diligent humble-bee, or from any other cause, the irregularity of the Hibiscus will be hastened.

The lower nectaries, being commonly neglected, are most likely to contain nectar; yet, if a bee finds no nectar in the first or second of the upper ones, it leaves the flower as if inferring that the lower are empty.

As stated above, Bombus Pennsylvanicus does not turn back, but sometimes sucks the fifth nectary (no. 1 in fig. 1) by squeezing under the column. This causes considerable delay, which is a disadvantage both to bee and flower. We

can see, therefore, how an abortion of the lower nectaries would be advantageous.

In the insect relations of this flower we find the conditions which have given rise to more complicated forms, and which may still further modify the Hibiscus.

When a flower with a single central nectary becomes horizontal, its new position makes access to the nectary useless, except on the upper side, and this makes possible different modifications of the lower parts, which make the nectar inaccessible except above. In many Papilionaceæ, for example, nine lower stamens are united, leaving a way to the nectar only on the upper side.

When the flower turns to an horizontal position, the effect on the petals is to deprive them of their function as a landing, and this makes possible many specializations for other purposes.

The upper petals remain expanded, so as not to come in the way of an insect lighting on the stamens and styles. Since an insect about to alight approaches the flower from above and in front, the upper petals are more conspicuous than the lower, which are hidden by the reproductive organs. The upper petals, therefore, retain their attractive function, while the lower lose this office, also, as well as that of a landing, so that the advertisement is retained on the upper side of the flower. In Papilionaceæ the upper petal is much enlarged, forming the vexillum. Irregular flowers of shallow origin, in general, have the upper petals larger and brighter colored.

Since the lower petals are deprived of their function both as organs of attraction and as a place of landing, and since access to the nectaries is no longer important on the lower side, these petals are free to assume any position and undergo any amount of modification which will fit them for a new function. In Gaura[16] they have turned so as to help the upper petals in attracting visitors. Often they become less expanded, aiding the stamens and styles as part of the landing. In Papilionaceæ two lower petals are united, forming a lighting-place for insects, increasing the attractiveness of the flower, protecting the stamens from rain and from pollen-eating intruders, and enabling them to strike the visitor with more precision[17].

[16] For illustration of Gaura Lindheimeri, see Wild Flowers of Am., pl. XXIII.

[17] While most Papilionaceæ are sternotribe, and all were no doubt originally so, in Phaseolus the keel guides the stamens against the insect's side, making the flower pleurotribe. In Apios the tip of the keel is fixed to the summit of the banner, and when dislodged must strike the insect's back, making the flower nototribe.

If the above observations indicate the conditions which have given rise to sternotribe flowers, irregular polypetalous flowers would be expected to be sternotribe, and this is the rule with them, as far as I know. Examples are: Delphinium, Aconitum (Ranunculaceæ), Hibiscus lasiocarpus (Malvaceæ), Pelargonium (Geraniaceæ), Æsculus (Sapindaceæ), Polygala (Polygalaceæ), Papilionaceæ, Gaura (Onagraceæ), Rhexia (Melastomaceæ), Cuphea viscosissima (Lythraceæ). Also, Hemerocallis, Pontederia, etc., among Monocotyledons.

Some of these flowers show no indications of the conditions which are supposed to have produced them. Thus, Trifolium pratense is no longer shallow, but is deep and tubular, the insect no longer lighting on the flower, but on the head, and the pollen is dusted on the under side of the bee's head or proboscis. My theory only requires what would be supposed from its affinities, viz., that the flowers were originally polypetalous and have become smaller and crowded. It not only follows from my theory that these flowers must have been visited separately by bees lighting on the stamens, but, as already observed, there are reasons for claiming that originally small, regular lateral flowers in close clusters would not be rendered irregular by insects. Moreover, the effect of insects visiting such flowers is so far from tending to make them irregular that it tends rather to turn such irregular flowers back to a more regular form; for, unless the organs are protected by a rigid galea or keel, the flowers will be fertilized by insects brushing over them, instead of applying pollen to the upper or under side of the insects. The flowers of Trifolium are protected, but Amorpha seems to have lost its papilionaceous character in this way. It has lost wings and keel, only retaining the vexillum, which makes the spikes more conspicuous, and its insect relations are much the same as in the apetalous Salix.

But there are some flowers of polypetalous origin which are nototribe, such as most orchids, Impatiens and Viola (sometimes).

The orchids must have been developed as sternotribe, and become nototribe by the twist in the ovary, which inverts the flower. The labellum must have been developed as an organ of attraction, like the vexillum of Papilionaceæ and the upper colored sepals of Pontederia, and has become a landing on account of the flower turning upside down. It is remarkable that these flowers, whose structure required

them to become sternotribe, should finally become the highest specialized of nototribe flowers, far outstripping those which became nototribe more readily, and assuming adaptations which aim at all parts of the upper sides of insects. Thus, Orchis pyramidalis[18] fastens its pollinia on the upper side of the proboscides of Lepidoptera; O. spectabilis fastens them on the smooth part of the face of female humblebees; Habenaria orbiculata, on the eyes of Sphingidæ;[19] Calopogon parviflorus, on the first segment of the abdomen of small bees;[20] the Calopogon seems to have gone through some remarkable changes. From being regular and dusting pollen indefinitely on the visitor, it first changed so as to dust the ventral surface. Then, inverting, it fastened the pollen on the upper side of the bee. Then it turned right side up again; but it has not, however, become again sternotribe, but remains the most remarkable of nototribe flowers. It has quit turning upside down to strike the insect's back. It turns the insect upside down to strike its stigma. As far as I know, Calopogon is the only nototribe flower of shallow origin which is not inverted.

Another nototribe flower, which is polypetalous, is Impatiens—at least, some of the species. They must have become sternotribe and then become inverted by becoming pendulous.[21]

Carlinville, Ill.

Some notes on Western Umbelliferæ. III.

JOHN M. COULTER AND J. N. ROSE.

Peucedanum Austinæ, n. sp. Resembling P. Hallii, but with leaf-segments larger and pinnate with narrow often toothed divisions; flowers purplish; fruit as in P. Hallii (3½ lines long, 1½ lines broad), except oil-tubes solitary in the dorsal intervals, mostly 2 in the laterals, 4 on the commissural side, and an additional one in each group of strengthening cells: seed-face concave, with central longitudinal ridge.—California. Plumas county (*Mrs. R. M. Austin*, June, 1880); near Yreka (*Greene* 732). Distributed as *P. Hallii* Watson.

[18] Darwin, "Fertilization of Orchids," 16.

[19] Gray's "Structural Botany," figs. 466 and 466a.

[20] Bot. Gazette XII, 288.

[21] Flores pedicello debili fulti, saepius propter pondus calcaris invertuntur, et calcar, reversa posticum, anticum apparet. Benth. & Hook. Gen. Plantarum, I, 277, Impatiens.

Peucedanum Grayi=*P. millefolium* Watson, King's Rep. v. 129, a name which must give way to the older *P. millefolium* of Sonder, from South Africa.

Peucedanum Parishii, n. sp. Caulescent, from a few inches to a foot high, glaucous, closely pubescent, from a thick elongated root: leaves pinnate, with pinnatifid to entire leaflets, the ultimate oblong-linear segments cuspidate, somewhat toothed or entire; root-leaves sometimes nearly entire or few-cleft: umbel 3 to 8-rayed, with no involucre, and involucels of small linear-lanceolate scarious-margined bractlets; rays an inch or more long; pedicels 2 to 4 lines long; flowers white: fruit somewhat obovate, glabrous, 3½ to 5 lines long, 2 to 3 lines broad, with narrow wings, and filiform or obsolete dorsal and intermediate ribs: oil-tubes exceedingly small, often obscure, 6 to 8 in the intervals, 8 to 10 on the commissural side: seed-face concave.—California, Bear Valley, alt. 6,500 ft. (*Parish* 1828); high ridges, north side of "Old Baldy" Mountain, San Bernardino county (*Parish* 1942). Collected at the former station June, 1886; at the latter, June, 1887.

Peucedanum Pringlei, n. sp. Very short caulescent or acaulescent, with several stout peduncles, 6 to 12 inches high from a common root, tomentose-pubescent: leaves rather small, pinnately decompound, with numerous short linear segments: umbel somewhat equally 6 to 12-rayed, with no involucre, and involucels of linear-lanceolate more or less tomentose bractlets; rays 1 to 3 inches long; pedicels 3 to 5 lines long; flowers white: calyx-teeth obsolete: fruit nearly orbicular, becoming glabrous at maturity, 4 to 6 lines long, 3½ to 4 lines broad, with thin membranous wings broader than the body, and filiform dorsal and intermediate ribs: oil-tubes large and solitary in the intervals (an occasional secondary one in the lateral intervals), 4 on the commissural side: seed deeply sulcate beneath the oil-tubes, with plane face.—California, San Diego county (*Pringle*, *Parry*, *Vasey*); New Mexico, Upper Gila (*Greene*). Flowers in April. Distributed variously as P. dasycarpum, P. caruifolium and P. fœniculaceum.

Peucedanum Watsoni, n. sp. Apparently acaulescent, but with a short subterranean stem from a deep-seated globose or oblong tuber with clusters of rootlets over its surface, and with or without a thick elongated root below, 2 or 3 inches

high, glabrous or puberulent: leaves bipinnate, the ultimate segments short and linear-oblong: umbel unequally 1 to 5-rayed, with no involucre, and involucels of more or less united often toothed bractlets; rays from almost wanting to an inch long: flowers white: fruit sessile or nearly so, ovate, rough-puberulent, 3 lines long, 1½ lines broad, with very narrow wings, and filiform or almost obsolete dorsal and intermediate ribs: oil-tubes (sometimes wanting) very obscure, 3 to 6 in the intervals, 1 in each rib, and 6 on the commissural side: seed-face plane.—Washington Territory, Cimcoe Mts. (*Howell*, in 1881), Cascade Mts. (*Brandegee*, in 1882, no. 320 of Canby's N. Transcontinental Survey), mountain summits near Columbus (*Suksdorf*), summit of high hills, Klickitat Co. (*Howell* 411, 412, 413); Oregon, high hills near the Dalles (*Howell C.*, in 1882), also Alkali (*Howell* 830, in 1882). Flowers May, June.

With pleasure we dedicate this mountain Peucedanum to one who has so long been a student of this perplexing genus.

Peucedanum Brandegei, n. sp. Short caulescent, glabrous, 6 inches to a foot high, from a thick elongated root: leaves ternately decompound, the ultimate segments lanceolate (6 to 12 lines long, 1½ to 3 lines wide), cuspidate pointed: umbel 6 to 12-rayed, with no involucre and involucels of few linear or setaceous bractlets; rays 3 to 6 lines long, pedicels not more than a line, both reflexed at maturity: flowers yellow: calyx-teeth evident: fruit (immature) oblong, glabrous, about 4 lines long and 2 lines broad (undoubtedly becoming larger), with wings about half as broad as body, and prominent or even slightly winged dorsal and intermediate ribs: oil-tubes 2 to 4 in the intervals, 4 to 6 on the commissural side.—Collected in Canby's N. Transcontinental Survey, in the Walla Walla region, Washington Territory, May, 1883 (*Brandegee* 799, *Tweedy* 856).

Peucedanum Hendersonii, n. sp. Acaulescent, from a shallow nearly globose constricted tuber (½ to 1 inch in diameter), glabrous: leaves ternate then bipinnate, ultimate segments short and obtuse: umbel equally 2 to 5-rayed, with no involucre, and involucels of linear acuminate scarious bractlets; rays about half-inch long; pedicels 1½ to 2 lines long; flowers white (Orogenia-like): fruit ovate, glabrous, 2½ lines long, 2 lines broad, with thickish narrow wings (not half as broad as body) more or less involute, filiform or nearly obsolete dorsal and intermediate ribs, and a rather prominent ridge

on the commissural face: oil-tubes solitary in the intervals, 2 on the commissural side: seed-face plane.—Oregon, John Day Valley, on high hill-tops, May, 1882 (*Howell* B in part), Lost Valley, June, 1882 (*Howell* 410). The fruit of this species, in its thickish involute wings and rather prominent commissural ridge, very nearly approaches that of *Orogenia fusiformis* Watson. Dedicated to L. F. Henderson, one of our best Oregon collectors.

Crawfordsville, Ind.

BRIEFER ARTICLES.

A date palm fungus (*Graphiola Phœnicis* Poit).—In the early part of 1887 this fungus was abundant on the fronds of the date palm in one of the conservatories of the United States Department of Agriculture, Washington, D. C. As it appeared again this spring with greater severity, and has been reported from other parts of the United States, it may be of interest to state briefly what is known concerning it, more particularly because its anomalous structure renders it a very interesting parasite.

This fungus appears indifferently on either side of the frond or axis in the form of small, roundish, sub-epidermal swellings, scattered or contiguous, which finally rupture the epidermis and protrude as black spore-bodies. These are rarely more than 1 to 1.5 mm. in diameter by 0.5 mm. high, the base being somewhat broader than the apex. As these bodies mature they become crateriform and from their center projects a curious bundle of bright yellow filaments, several millimeters in length. Filling the bottom of this cavity and suspended between the filaments at this stage of growth are innumerable sulphur yellow spores which, when the fronds are shaken, fly off in a manner quite suggestive of diminutive showers of pine pollen. Most of these spore-bodies were very superficial, being confined exclusively to the epidermis, the deeper tissues of the frond being green quite up to the borders of the fungus and beneath it. In some instances, however, the deeper tissues also suffered, and in a very few they had become yellow for a distance of several millimeters, especially in the direction of the longer axis of the pinnæ, and particularly when the fruit bodies were clustered. On some fronds there were hundreds of these bodies, so that they had a fly-specked appearance. Other fronds upon the same plant appeared to be less affected, and some adjacent plants were entirely exempt.

According to Fischer, the black rim of the crater, the peridium, grows out of a hyphæ-complex, or pseudo-parenchymatous substratum, and consists of parallel hyphæ arranged nearly at right angles to the plane of the frond. These hyphæ are more or less branched, and are

united by a black exudate, soluble in various reagents. There is also a delicate inner peridium, quite apparent in some species of Graphiola, but not easily demonstrated in this one. The long yellow filaments are composed of parallel mycelial threads, each strand or filament containing fifty or more united into one body. From the pseudo-parenchymatous floor of the crater, between the bases of the yellow filaments, arise many elongated, unbranched or basally branched, colorless hyphæ, which constrict into nearly isodiametric cells. On the side wall of these cells the nascent spores appear in the form of buds, which enlarge, become separated from the mother cell, grow and subdivide after separation, to become finally the round or ellipsoidal, smooth-walled, one-celled or two-celled, mature spore. The nascent spores develop on the hyphæ basipetally. There are usually from three to six on each mother cell, and all of these mature at the same time. The mother cell often separates from the hyphæ along with the nascent spores, to which it remains attached for some time. The ripe spores are three to six millimeters in diameter, with a somewhat thick episporium, and a contents showing refractive particles. They germinate in water by the formation of a promycelium and sporidia or by the direct production of a germ-tube.

This fungus was first described by Fries, in 1823, as Phacidium. Many have since written upon it, but its structure, and probable affinity, were first clearly pointed out by Ed. Fischer in 1883. Its classification has been a mooted question, if, indeed, it be yet definitely settled. Fries, Kunze, Duby and Montagne placed it under Ascomycetes; Chevallier, Corda and Bonorden thought it belonged to Uredineæ; while Poiteau and Levillé looked upon it as one of the Myxomycetes. Fischer places it with the Ustilagineæ, or more strictly in a closely allied group under the name Graphiolaceæ. In general appearance, it must be confessed, it is not at all like the smuts, but it does not seem to be dimorphous, and it agrees pretty well with some of the smuts in the manner of spore-formation and mode of germination. In having a persistent mycelium in the form of a peridium it recalls Dossansia, Sphacelotheca, and similar aberrant forms of the Ustilagineæ, which, though perplexing to the systematist, are very interesting to the student of evolution.

After many failures Fischer succeeded in growing the fungus. The spores were sown in December on the immature fronds of a young palm, and the characteristic fungus spots first appeared in the following October.

Graphiola Phœnicis is very widely distributed. It occurs in India, Algiers, Egypt (?), Italy, Austria, Germany, Holland, Belgium, England, Scandinavia, French Guiana, and the United States.

It would be interesting to know to what extent this fungus occurs in the palm houses of this country. Dr. Farlow informs me that he has received it from several localities. The specimens collected by Ravenel in S. C., on Chamærops, and published in *Fungi Carolliniana*, Fasc. 4., No. 72,

as G. Phœnicis, either do not belong to this genus or are a distinct species, named provisionally *G.* (?) *compressa* Fisch.

The most important paper is *Beitrag zur Kentniss der Gattung Graphiola.* Ed. Fischer, *Bot. Zeit.* 1883, Nos. 45, 46, 47 and 48.

Bot. Lab., Univ. of Michigan. ERWIN F. SMITH.

Parasitic fungi of Missouri.—During the past five or six years the writer has devoted considerable attention to the fungi of Missouri, and during that time, with the assistance of Prof. S. M. Tracy and Rev. C. H. Demetrio, about 400 strictly parasitic species have been taken. Most of the species were taken in the central and southeastern parts of the state and, while no collections of importance were made in the western counties, late observations in these parts have convinced me that here the flora, so far as relates to fungi, is practically the same as that of the more carefully explored region. With very few exceptions, all of the species taken have been preserved either in my own herbarium or that of Mr. Demetrio.

Quite a number of the species have been distributed in Ellis' *North American Fungi* and Winter's *Fungi Europaei et Extra Europaei.* A careful list of all the species, together with their hosts, has lately been prepared, and as it now stands this list includes the following:

Uredineæ, 105 species, divided among the following genera: Æcidium, isolated forms, 41; Cæoma, 2; Coleosporium, 2; Gymnosporangium, 1; Melampsora, 4; Peridermium, 1; Phragmidium, 3; Puccinia, 33; Rœstelia, 2; Uredo, 2; Uromyces, 14.

Ustilagineæ, 16 species, divided as follows: Doassansia, 1; Entyloma, 3; Tilletia, 2; Urocystis, 1; Ustilago, 9.

I have several times collected a curious Ustilago upon Polygonum Hydropiper. The fungus attacks the flowers and greatly distorts them, producing in many cases large black globular swellings. This is probably the same form mentioned by Dr. Farlow (BOT. GAZETTE, viii, 277) as resembling *U. Bistortarum* (DC.). What appears to be the same thing has lately been issued in Dr. Winter's *Exsiccatæ* under the name *U. Austro-Americana* Spez., from South America.

Peronosporeæ, 17 species, distributed as follows: Cystopus, 5; Peronospora, 11; Phytopthora, 1.

Erysipheæ, 24 species, upon 47 hosts, as follows: Erysiphe, 3; Microsphæra, 8; Phyllactinia, 1; Podosphæra, 1; Sphærotheca, 5; Uncinula, 6.

Imperfect forms, nearly 200 species, so called, divided among the following genera: Asterina, Cercospora, Cladosporium, Coniothyrium, Cylindrosporium, Diplodia, Entomosporium, Gleosporium, Ramularia, Septoria, etc.

The remainder of the list, some 35 species or more, is made up of members of the following genera: Epichloe, Leptosphæria, Phyllachora, Sphærella, Taphrinia, etc.—B. T. GALLOWAY, *Washington, D. C.*

The black maple.—Last fall I contributed to an horticultural journal

an account of the conspicuous differences between Acer saccharinum and its so-called variety nigrum, giving figures of the characteristic dissimilarities in foliage and fruit.[1] The statement was made that the two maples are evidently specifically distinct. At all events, they are so unlike in general appearance that they may be recognized at a glance at a distance of four or five rods. In ornamental value they are clearly different. A new study of trees in flower and in young foliage also reveals characteristic differences. In my judgment the two are distinct species. I have not been able to detect intermediate forms. The following characterizations will separate them.

Acer saccharinum Wangenheim.—Leaves three to five-lobed, the sinuses narrow and deep, the lobes furnished with large and long-acuminate teeth, glabrous, plane, rather thin, the basal sinus open; stipules none: nodes of the young shoots usually reddish: inflorescence smooth or nearly so; bracts none or minute: staminate flowers somewhat campanulate; the calyx two lines or less in length: lobes of the fruit little spreading.

Acer nigrum Michaux.—Leaves larger, three-lobed, the sinuses very broad and shallow, the lobes entire or very bluntly toothed, the apex not so prominently acuminate, pubescent or villous beneath and also on the petiole when young, limp, the sides conspicuously drooping, thick and soft, the basal sinus usually closed or the lobes overlapping and causing the leaf to appear slightly peltate; stipules conspicuous, foliaceous and ciliate, early caducous;[2] nodes of the young shoots not colored: inflorescence pubescent or villous; the bracts conspicuous and ciliate: staminate flowers cylindrical; the calyx two and a half or more lines long: fruit smaller, the lobes usually diverging.—In aspect this species is much heavier and duller than the other, owing to the drooping and wilted appearance of the large cloth-like leaves.—L. H. Bailey, *Agricultural College, Mich.*

EDITORIAL.

It is thought by some to be desirable for every form of scientific work to have its center at Washington. The reason for this is partly sentimental, for it sounds large to have a "national" museum or a "national" herbarium, and partly financial, for it is argued that only the government can support such things in any worthy way. The financial reason is a good one, as any one will concede, for that government which has given its fostering care most liberally to scientific work has to-day

[1] *Popular Gardening*, Nov. 1881, 24, 4 figs.

[2] Observations upon the occurrence of stipules in this species are also recorded in *Amer. Nat.*, vi, 767, vii, 422, and by Wheeler, *Mich. Cat.*, 23.

the proud satisfaction of seeing the scientific world flocking to its doors to learn wisdom. Our government has already given enough money to scientific work in botany and agriculture to have shown great results if rightly directed; but the results have mainly been a few padded "reports" of aimless experiments and meaningless lists and centennial "displays." Periodical "reports," gotten up with the sole idea of having every one so many pages long, or with the inspiring thought that it is so many pages longer than the last one, and "displays," express the whole desire and appreciation of our government with respect to scientific work. It is not the fault of our brethren who have the good fortune to be "government" scientists, for they are good men and anxious to do good work. But there is a factor in the whole organization of such scientific work which is fatal to good results, necessarily so; and that is, that every position is filled and every position held by that hobgoblin "political influence." When they who hold the appointing power use it to fill scientific positions for political reasons, it is hardly likely that any "science" that the world will hear of will be the result. If half of the attachés in such "centers of work" are not so much mere rubbish in the way of the other half who have the ability to work, we are much mistaken, although we may have the proportion wrong. Our plea, then, is for politics to be banished, along with the "rubbish" referred to, reports not demanded until there is something to report, the "show business" given over to perfectly capable but less scientific hands, and the specialist thus be given leisure to do work that will be a credit to himself and the government that is paying for it.

OPEN LETTERS.

White flowered Linum perenne.

The instances are very numerous in which species both of animals and plants which exist in the colder regions of British America and on the mountains of Europe are common also to the elevated portions of Colorado; and it was therefore with peculiar interest that I recognized in the white-flowered form of Linum perenne, stated by Prof. Jas. Macoun (p. 116) to be characteristic of James Bay and Hudson Bay, a form I have myself met with in Colorado. The typical form of L. perenne is common in Colorado at about 8,000 feet, but above 9,000 its place is taken by a somewhat lower variety, with deeper blue petals, and, although the white form is also alpine, I only met with it on one occasion, near the boundary line between Montrose and Gunnison counties. It would be interesting to learn whether this variety exists at all in the northern or alpine regions of Europe.

THEO. D. A. COCKERELL.

West Cliff, Colorado.

Buchloe dactyloides.

Ever since Nuttall, in 1818, wrote of it, *Buchloe dactyloides* Engelm. has been recognized as one of the best forage grasses of the plains. For-

merly vast herds of buffalo, and at present the herds and flocks of the western stockman, obtain from it a great part of their winter's food. The reason of this lies in the fact that in the mature plant, as found in autumn and winter, the solid culms and stolons, together with the leaves, are perfect store-houses of food materials. Every parenchyma cell is packed with starch grains. Buchloë, when ripe, furnishes more nutriment, considering the size of the plant, than almost any other grass.

Lincoln, Neb. JARED G. SMITH.

Color variation in flowers of Delphinium.

The dwarf larkspur, *Delphinium tricorne* Michx., is a common plant in many parts of the Mississippi valley, and is the only one, so far as I know, growing in the immediate vicinity of St. Louis. It is well marked by its cluster of tuberous thickened roots, the three pistils to each flower, and smooth seeds. The flowers are usually blue, and our manuals say occasionally white; but till this spring I did not see any of the white forms. Early this spring a great deal of it was found on the rocky limestone bluffs at Glencoe, Mo., appearing somewhat earlier than the blue form. Some weeks later I had occasion to collect in the region of Bluff Lake, well known to local botanists for the number of interesting phænogams found there. Not only did I find large numbers of the white-flowered form, but a beautiful purple-flowered form. This form was found, along with the blue and white forms, in rich woods. Mr. Letterman, who has closely observed this species for many years at Allenton, Mo., says the white form is not uncommon. For several years I have also observed *Delphinium azureum* Michx. at La Crosse, Wis. It is common on silicious soils. The flowers of this species are usually sky-blue or whitish, according to descriptions. So far I have not found a single blue-flowered form at La Crosse. The flowers were always white or greenish white, very much like the white form of *Delphinium tricorne*.

St. Louis, Mo. L. H. PAMMEL.

CURRENT LITERATURE.

North American Geraniums.[1]

Our Geraniums have not been revised since Torrey & Gray's Flora, about 50 years ago. In the memoir before us Dr. Trelease has presented, with his usual completeness, not only descriptions of all our species, but some biological notes concerning them, their pollination, dissemination, etc. Of the genus Geranium we have 10 native species; Erodium has 4; Limnanthes 4, among which is a new species (L. Macounii) from Vancouver Island; Floerkea 1; Oxalis 13, with a new species (O. Suksdorfii) from Oregon. It seems that Elliott's O. recurva ranges north into Ohio, Indiana, etc., having been taken for a large form of O. corniculata, var. stricta (O. stricta of the Manual). With the 2 species of Impatiens, we have thus 34 native Geraniums. The author's biological notes concerning these various species are full of interest, but too detailed for proper presentation in this review.

1 TRELEASE, WILLIAM.—North American Geraniaceæ. From the Memoirs of the Boston Soc. Nat. Hist. iv, pp. 71–103, with 4 plates. [Issued January, 1888.]

Minor Notices.

A LIST of species found by Mr. Henry M. Ami near Lake Temiscouata, in Quebec, is reprinted from the *Bull. Torrey Bot. Club*, pp. 134–136.

THE MICROSCOPICAL anatomy of the cedar apple (Gymnosporangium macropus) is treated by Mr. Elmer Sanford in the *Annals of Botany* for February, 1888, and is also issued as a separate reprint.

THE DEPARTMENT OF AGRICULTURE undertook some time ago an investigation of the problem of discovering what plants could be grown upon the arid regions of the southwest. Bulletin number six[2] gives a report of collections and notes made by Mr. G. C. Nealley in Texas, and by Prof. S. M. Tracy in Arizona, New Mexico, Nevada and Utah. About 200 species were collected, upon which various notes of greater or less interest are given. The conclusion reached from the reports is: "We may be assured that there are many which would prove useful in cultivation, and it is to be hoped that the experiment stations of the states embraced in the arid districts will give such a thorough trial." Which ones?

THE FOURTH FASCICLE of Castillo's *Illustrationes floræ insularum maris Pacifici* fulfills the promise of its predecessors. The ten lithographic plates are charming, while the text of the ten species is correspondingly elaborate. The species are all Compositæ, viz.: Erigeron, 2 species; Lipochæta, 5 species (3 of them new); Bidens, 3 species (1 new).

THE SECTION of Vegetable Pathology of the Department of Agriculture has been giving special attention to the diseases of the grape. Bulletin No. 5[3] gives an account of the experiments in the application of various liquid and dry fungicides, such as sulphatine, etc., the basis of all of which is sulphate of copper. The results are somewhat contradictory, but sufficiently accordant to show that the remedies, or preventives rather, are valuable, and the experiments should be continued. As a supplement to the report appears a valuable chapter upon apparatus for applying fungicides, communicated by M. Paul Ferrouillat, professor of rural engineering at the National School of Agriculture, Montpellier, France. The bulletin shows a wide-awakeness and energy in this section which are highly commendable. It is to be hoped that Commissioner Colman will be able to secure an active and able successor for Mr. Scribner, whose administration has been most praiseworthy.

[2] VASEY, GEO.— Grasses of the Arid Districts (Dept. Agric., Bot. Div., Bull. No. 6), pp. 60, pl. 30, 8vo. Washington: Govt. Printing-office, 1888.

[3] SCRIBNER, F. LAMSON.— Report on the experiments made in 1887 in the treatment of the downy mildew and the black-rot of the grape-vine, pp. 113, pl. 1, figs. 24, 8vo. Washington: Government Printing-office. 1888.

NOTES AND NEWS.

DR. LUCIEN M. UNDERWOOD will spend the summer in rummaging California for Hepaticæ.

DR. MAXWELL T. MASTERS has been elected a corresponding member of the Institute of France in place of Dr. Asa Gray.

DR. JOSEPH SCHENCK, in *American Druggist* (June), publishes some "pharmacognostical notes," with illustrations, chiefly upon Mentha.

MISS HENRIETTA E. HOOKER, of Mt. Holyoke Seminary, sailed for Europe on the 23d of June, to be absent for six months of study in German laboratories.

IN *Garden and Forest* (July 18) Mr. Watson figures and describes *Amelanchier oligocarpa* Roem. as worthy of specific rank. It is the A. Canadensis var. oligocarpa of the Manual.

A SUMMER SCHOOL of science, specially for teachers, opened at the University of Wisconsin July 10, and closes August 10. It includes elementary and advanced courses in botany, conducted by Prof. Barnes and Mr. H. L. Russell.

"CONCERNING the potato tuber" is the subject of the last Bulletin of the Indiana Agricultural Experiment Station by the botanist, Dr. J. C. Arthur. Although mainly to instruct the cultivator, it has points of interest for botanists.

IN THE *Journal de Botanique* (July 1) there is a biographical notice of the late Jules-Emile Planchon, by M. Louis Morot, with a full bibliography. The same number also contains a very interesting picture of "Le Jardin des Plantes" in 1636.

THE COUNCIL of the Royal Microscopical Society of London has determined to abandon the term micro-millimeter for the $\frac{1}{1000}$ of a millimeter, and use in the Journal and Proceedings the term *micron*. It would be wise for all to follow this usage.

DR. J. V. HABERER has prepared a list of the spring plants in the vicinity of Utica, N. Y., which is published by the Asa Gray Botanical Club of that city, of which he is president. A radius of seven miles is the limit, and the twenty-page pamphlet shows a rich spring flora.

WAKKER'S observations upon a large number of seeds lead him to believe that aleurone grains are not always protoplasmic, but often vacuoles filled with soluble albuminoids. In this case the crystals and crystalloids found within the "grain" would be derived from the cell-sap.

THE GENUS Tillandsia is completed by Dr. Baker in *Journal of Botany* (June), with 241 species, 64 of which are published for the first time. In two cases the author gave the same name to two different species, overlooking the fact that it had already been bestowed. This gives the editor a chance in a foot-note to call one of these T. Bakeriana.

THE FUNCTION of the tannin group is comparatively obscure. Tannins are not transferred from the leaves before their fall, and, *a priori*, would seem to be products of no further use to the plant. Although glucosides, rich in carbon and oxygen and often associated with glucose, they are not used in the processes of growth, though perhaps they take part in the formation of resins. Prof. W. Hillhouse has some interesting papers on this subject in four recent numbers of the *Midland Naturalist* (Nov., 1887–Feb., 1888).

PROF. GRAF ZU SOLMS LAUBACH, of the Botanical Institute at Tübingen, became associated with Dr. Wortmann in the editing of the *Botanische Zeitung* on the 1st of July. Count Solms will be a worthy successor to the lamented DeBary. Original contributions are to be sent to him, while books and all papers for review are to be addressed to Dr. J. Wortmann at Strassburg.

ROBERT DOUGLAS, in a note on the longevity of coniferous tree seeds (*Garden and Forest*, July 18), says he finds that these seeds preserve their vitality longer in dry climates, like Colorado, than is generally supposed. Seeds of Pinus ponderosa were found to germinate as freely the fifth year as the first, while those of Picea pungens and Pseudotsuga Douglasii germinated readily the third year.

THE COMPOSITÆ have heretofore borne a good reputation, and their harmlessness is impeached for the first time by MM. Heckel and Schlagdenhauffen, who report (*Comptes Rendus*, May 14, 1888, p. 1446) the discovery of a glucoside in *Vernonia nigritiana* Oliver et Hirn, which acts upon the heart in the same manner as digitaline, arresting it in systole. This glucoside they call *vernonine*, and state its composition as $C_{10}H_{24}O_7$. It is twenty-four times less powerful than digitaline.

JOST has recently worked out the development of the Mistleto (Viscum album), of which, though often studied, reliable data regarding the origin of the embryo-sac and the development of the anther were lacking. The degeneration of the reproductive organs through parasitism is very interesting. Herr Jost's summary is as follows: "Viscum album has its reproductive organs very much reduced; the ovules have degenerated to simple macrospores (embryo-sacs) which arise at the apices of the floral axes; the anthers (microsporangia) are placed not upon specialized staminal leaves, but upon the perianth, in which structure they resemble more those of many vascular cryptogams than those of most angiosperms." The details of this interesting paper see *Bot. Zeit.* nn. 23, 24, 1888.

ULOTA PHYLLANTHA, heretofore only known from sterile specimens, has been found fruiting by Mr. Thomas Howell in Oregon. The fruit is described by MM. Renauld and Cardot in the *Revue Bryologique*, 1888, no. 3, p. 36. At a meeting of the Torrey Botanical Club on May 8 (reported in the *Bulletin* for June), Mrs. E. G. Britton exhibited slides and drawings of fruit and flower from specimens of the same collection. Upon this, together with a letter to M. Cardot, dated March — ? announcing the discovery, Mrs. Britton claims priority. It is a matter of small consequence, but we can hardly believe that two such distinguished bryologists would have described the fruit without any reference to Mrs. Britton's communication had it really called their attention to the matter for the first time.

IN THE *Journal of Botany* for July a report is given of an address on root pressure before the Linnæan Society of London by Mr. C. B. Clarke. Mr. Clarke read the commonly accepted doctrine of root pressure as laid down by Sachs, and proceeded to deny the existence of any such force. He would consider the whole *mechanical* fluid action in plants in accordance with the laws of capillarity, and believes that the fluid pressure in every plant cell is nearly zero. To avoid the difficulty that water could not rise to such heights in capillary tubes, he says that water raised a quarter of an inch in one tube may laterally (by pressure or otherwise) pass into another and there rise by capillary action another quarter-inch, and so on nearly *ad infinitum*. We hardly think that this view will be favorably received by plant physiologists.

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DR. JOSEPH SCHENCK, in *American Druggist* (June), publishes some "pharmacognostical notes," with illustrations, chiefly upon Mentha.

MISS HENRIETTA E. HOOKER, of Mt. Holyoke Seminary, sailed for Europe on the 23d of June, to be absent for six months of study in German laboratories.

IN *Garden and Forest* (July 18) Mr. Watson figures and describes *Amelanchier oligocarpa* Roem. as worthy of specific rank. It is the A. Canadensis var. oligocarpa of the Manual.

A SUMMER SCHOOL of science, specially for teachers, opened at the University of Wisconsin July 10, and closes August 10. It includes elementary and advanced courses in botany, conducted by Prof. Barnes and Mr. H. L. Russell.

"CONCERNING the potato tuber" is the subject of the last Bulletin of the Indiana Agricultural Experiment Station by the botanist, Dr. J. C. Arthur. Although mainly to instruct the cultivator, it has points of interest for botanists.

IN THE *Journal de Botanique* (July 1) there is a biographical notice of the late Jules-Émile Planchon, by M. Louis Morot, with a full bibliography. The same number also contains a very interesting picture of "Le Jardin des Plantes" in 1636.

THE COUNCIL of the Royal Microscopical Society of London has determined to abandon the term micro-millimeter for the $\frac{1}{1000}$ of a millimeter, and use in the Journal and Proceedings the term *micron*. It would be wise for all to follow this usage.

DR. J. V. HABERER has prepared a list of the spring plants in the vicinity of Utica, N. Y., which is published by the Asa Gray Botanical Club of that city, of which he is president. A radius of seven miles is the limit, and the twenty-page pamphlet shows a rich spring flora.

WAKKER'S observations upon a large number of seeds lead him to believe that aleurone grains are not always protoplasmic, but often vacuoles filled with soluble albuminoids. In this case the crystals and crystalloids found within the "grain" would be derived from the cell-sap.

THE GENUS Tillandsia is completed by Dr. Baker in *Journal of Botany* (June), with 241 species, 64 of which are published for the first time. In two cases the author gave the same name to two different species, overlooking the fact that it had already been bestowed. This gives the editor a chance in a foot-note to call one of these T. Bakeriana.

THE FUNCTION of the tannin group is comparatively obscure. Tannins are not transferred from the leaves before their fall, and, *a priori*, would seem to be products of no further use to the plant. Although glucosides, rich in carbon and oxygen and often associated with glucose, they are not used in the processes of growth, though perhaps they take part in the formation of resins. Prof. W. Hillhouse has some interesting papers on this subject in four recent numbers of the *Midland Naturalist* (Nov., 1887–Feb.; 1888).

PROF. GRAF ZU SOLMS-LAUBACH, of the Botanical Institute at Tübingen, became associated with Dr. Wortmann in the editing of the *Botanische Zeitung* on the 1st of July. Count Solms will be a worthy successor to the lamented DeBary. Original contributions are to be sent to him, while books and all papers for review are to be addressed to Dr. J. Wortmann at Strassburg.

ROBERT DOUGLAS, in a note on the longevity of coniferous tree seeds (*Garden and Forest*, July 18), says he finds that these seeds preserve their vitality longer in dry climates, like Colorado, than is generally supposed. Seeds of Pinus ponderosa were found to germinate as freely the fifth year as the first, while those of Picea pungens and Pseudotsuga Douglasii germinated readily the third year.

THE COMPOSITÆ have heretofore borne a good reputation, and their harmlessness is impeached for the first time by MM. Heckel and Schlagdenhauffen, who report (*Comptes Rendus*, May 14, 1888, p. 1446) the discovery of a glucoside in *Vernonia nigritiana* Oliver et Hirn, which acts upon the heart in the same manner as digitaline, arresting it in systole. This glucoside they call *vernonine*, and state its composition as C_{10} H_{24} O_7. It is twenty-four times less powerful than digitaline.

JOST has recently worked out the development of the Mistleto (Viscum album), of which, though often studied, reliable data regarding the origin of the embryo-sac and the development of the anther were lacking. The degeneration of the reproductive organs through parasitism is very interesting. Herr Jost's summary is as follows: "Viscum album has its reproductive organs very much reduced; the ovules have degenerated to simple macrospores (embryo-sacs) which arise at the apices of the floral axes; the anthers (microsporangia) are placed not upon specialized staminal leaves, but upon the perianth, in which structure they resemble more those of many vascular cryptogams than those of most angiosperms." The details of this interesting paper see *Bot. Zeit.* nn. 23, 24, 1888.

ULOTA PHYLLANTHA, heretofore only known from sterile specimens, has been found fruiting by Mr. Thomas Howell in Oregon. The fruit is described by MM. Renauld and Cardot in the *Revue Bryologique*, 1888, no. 3, p. 36. At a meeting of the Torrey Botanical Club on May 8 (reported in the *Bulletin* for June), Mrs. E. G. Britton exhibited slides and drawings of fruit and flower from specimens of the same collection. Upon this, together with a letter to M. Cardot, dated March — ? announcing the discovery, Mrs. Britton claims priority. It is a matter of small consequence, but we can hardly believe that two such distinguished bryologists would have described the fruit without any reference to Mrs. Britton's communication had it really called their attention to the matter for the first time.

IN THE *Journal of Botany* for July a report is given of an address on root pressure before the Linnæan Society of London by Mr. C. B. Clarke. Mr. Clarke read the commonly accepted doctrine of root pressure as laid down by Sachs, and proceeded to deny the existence of any such force. He would consider the whole *mechanical* fluid action in plants in accordance with the laws of capillarity, and believes that the fluid pressure in every plant cell is nearly zero. To avoid the difficulty that water could not rise to such heights in capillary tubes, he says that water raised a quarter of an inch in one tube may laterally (by pressure or otherwise) pass into another and there rise by capillary action another quarter-inch, and so on nearly *ad infinitum*. We hardly think that this view will be favorably received by plant physiologists.

AN INTERNATIONAL American Congress will be held in Berlin, in October next, to discuss historical, geographical, ethnographical, linguistic and similar subjects relating to the American continent. Of the thirty-seven topics arranged in the preliminary programme, only one is botanical—the economic plants of the ancient Peruvians, introduced by Dr. Wittmack, of Berlin.

THE NEW marine biological laboratory established at Wood's Hall, Mass., deserves success. It opened its first season July 10, under the directorship of Dr. C. O. Whitman, and will close September 22. It is open for both investigators and students. The situation is all that could be desired, both as a delightful place for the summer and as affording abundant and varied material. It will be remembered that Dr. Farlow had his summer class at this place on account of its rich display of algæ.

DR. H. RODEWALD has attempted to investigate[1], by means of chambers constructed for the purpose, the amount of heat given off by plants in the process of respiration, comparing this with the quantity of CO_2 eliminated. The objects experimented on were ripening apples and potatoes. He finds that always by far the larger part of the energy set free by respiration is given off in the form of heat. Supposing the whole of the CO_2 to result from the combustion of starch, he found the actual quantity of heat developed to be 92.2 per cent. of that which would be due theoretically to the consumption of the corresponding amount of starch. The contrivances by which the vitiation of the results through errors was prevented are described in detail. The loss of heat from transpiration could be estimated from the loss of weight, from which the quantity of carbon consumed in respiration must be deducted. The specific heat of the body experimented on was determined by a calorimeter to be about 0.924. The quantity of CO_2 evolved was estimated at the same time in all the experiments.—*Jour. Roy. Mic. Soc.*

THE CENTENARY of the Linnean Society of London, May 24, was a very interesting occasion. The president, Mr. W. Carruthers, delivered his annual address, in which he referred to the losses sustained by the society during the past year, mentioning prominently DeBary and Gray. In accordance with the spirit of the occasion, he spoke of the work of Linnæus, the transference of his collections to England, and the development of the Linnean Society. Then a eulogium upon Linnæus was read, having been prepared by Prof. Thöre Fries, the present professer of botany at Upsala. After an account of the marvelous work of Linnæus, he closed as follows: "The precious gift of Sir James Edward Smith (the Linnean collections) was indeed a noble seed, since grown up into a strong plant, which has borne flowers and fruits from year to year in abundance. Its vitality is a guarantee that it will thrive and flourish so long as the Linnæa borealis, ever green, spreads its fragrance over young and old, high and low, rich and poor, in the mighty forests of the north." Sir Joseph Hooker pronounced the eulogium on Robert Brown, recognized as the greatest botanist of his age. He said that Brown's collection of about 4,000 species of plants belonging to all orders, and three-fourths of them new to science, in nine years, was a feat unexampled in the history of botanical science. Professor Flower gave the eulogy on Charles Darwin, and Mr. Thiselton Dyer upon George Bentham. The Linnean gold medal was presented to Professor Owen and Sir Joseph Hooker.

[1] Pringheim's Jahrb. f. Wiss. Bot. xviii (1887), pp. 263-345.